AWEA AMERICAN WIND ENERGY ASSOCIATION

Emerging Manufacturing Opportunities – A National Perspective

July 21, 2010

Jeff Anthony
American Wind Energy Association

What is AWEA ?

- American Wind Energy Association

  www.awea.org

- National trade association for the wind energy industry
  - Legislative / Lobbying
  - Education & Outreach
  - Member Services
- Currently >2400 business, utility, academic, and non-profit members

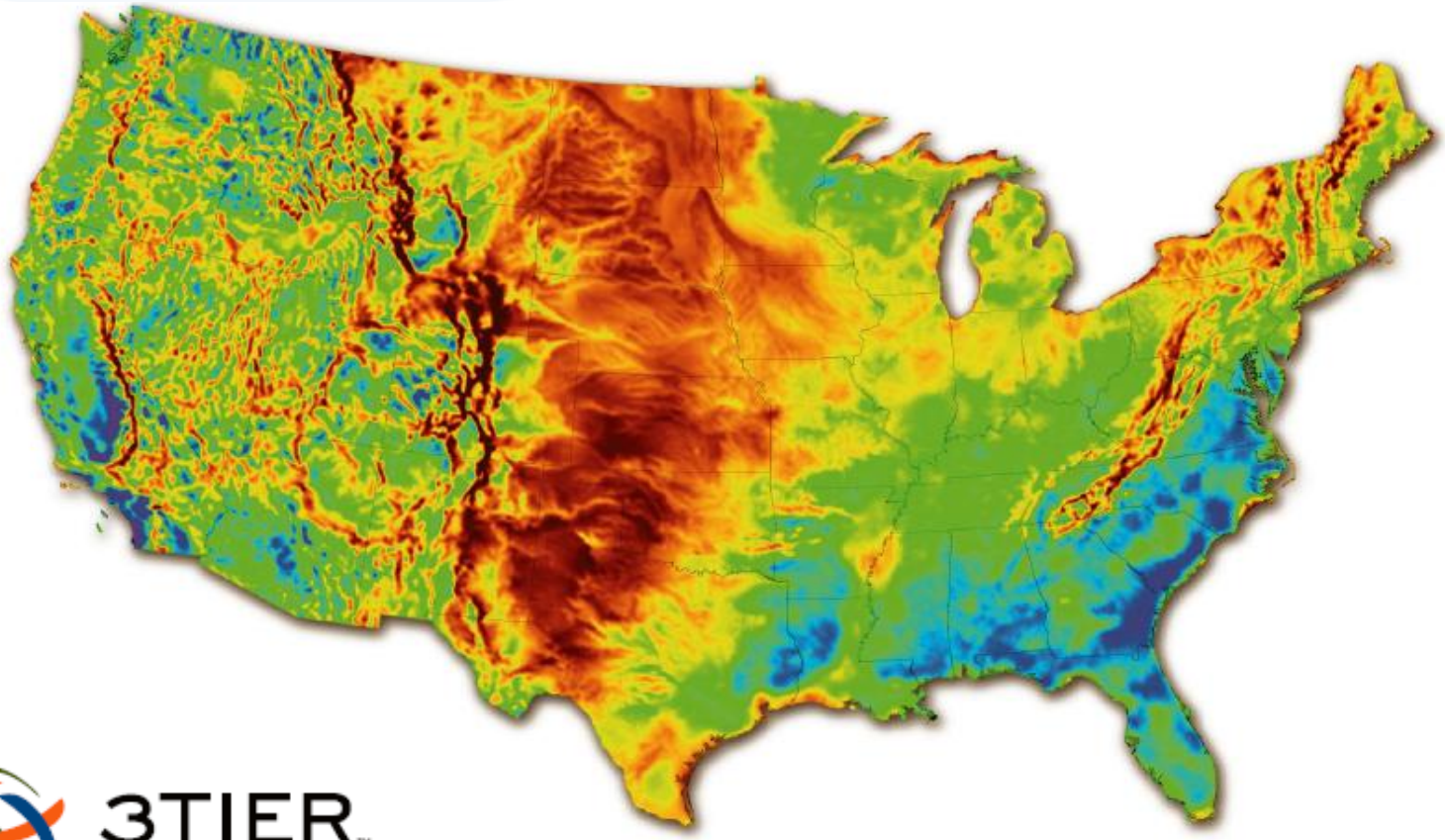
U.S. is World Leader in Wind Power

- In 2009, US broke all records by installing nearly 10,000 MW.
- The total installed capacity in the US is now over 35,000 MW.
- The U.S. is the #1 wind power producer in the world.

Wind Power Offers Price Stability

- Electricity from wind is inflation-proof once wind farm is installed
- Known pricing can offer hedge against fuel price volatility risk

U.S. Wind Resource Map



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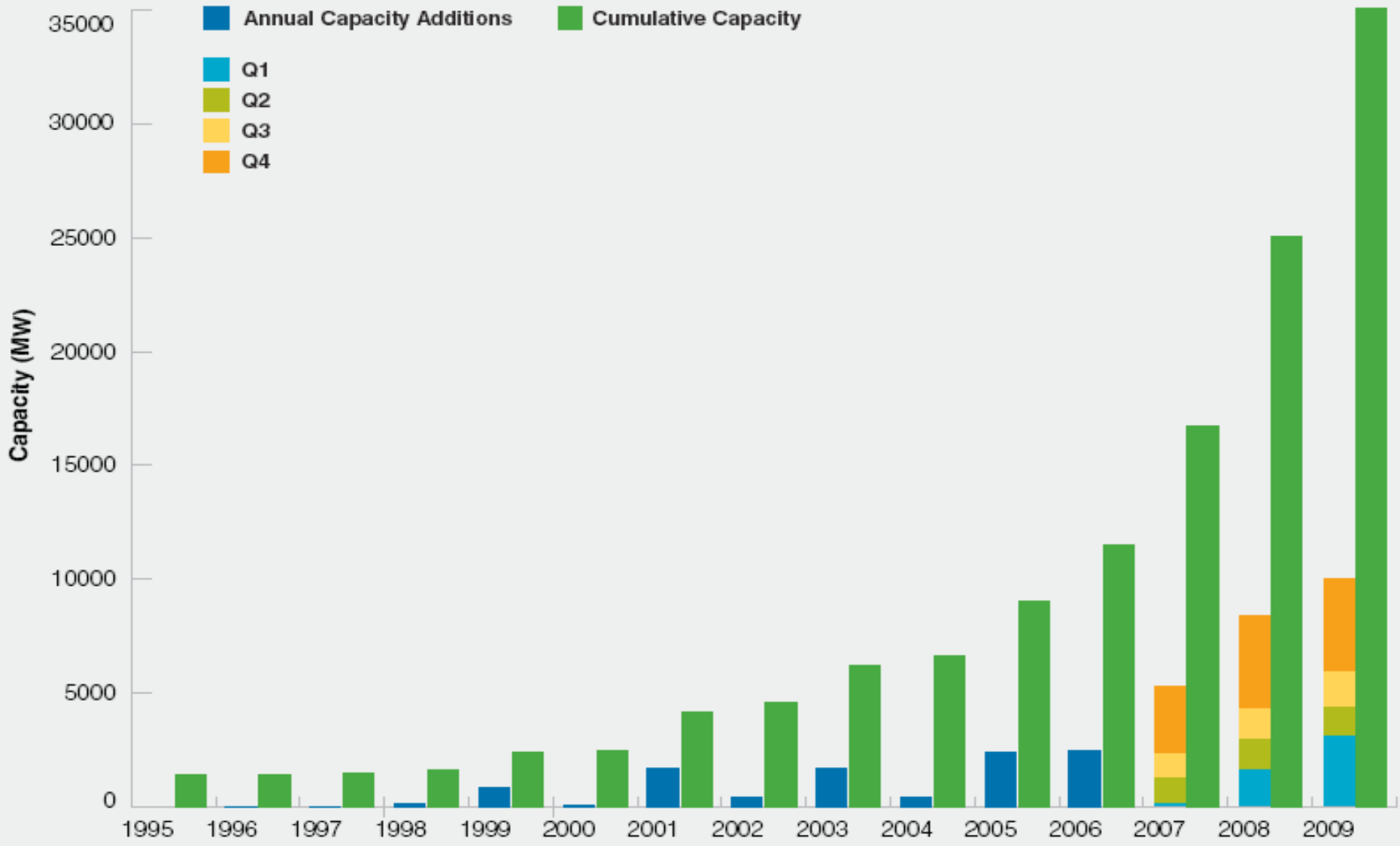
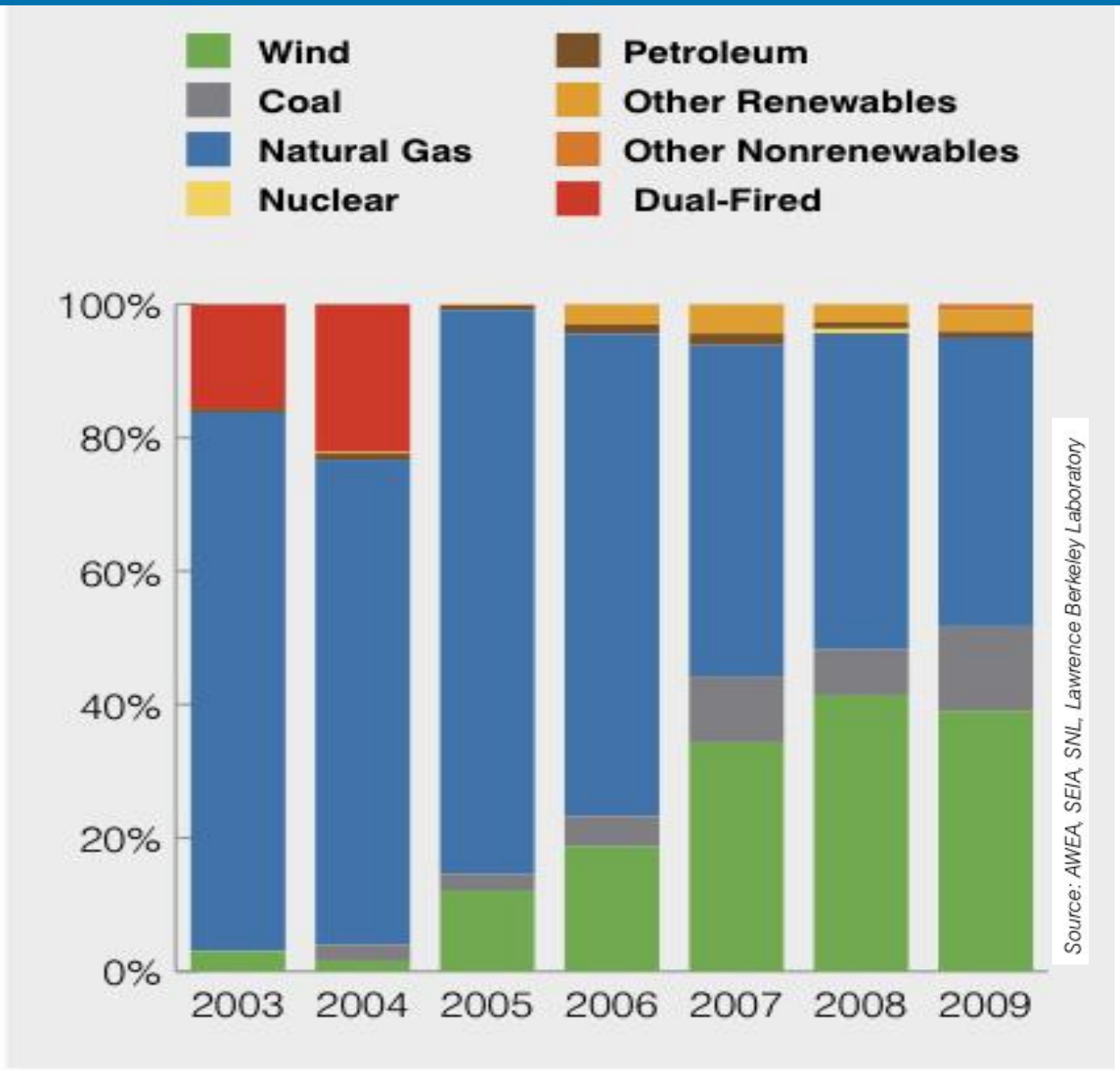
Status of the Wind Energy Industry

U.S. ANNUAL AND CUMULATIVE WIND POWER CAPACITY GROWTH



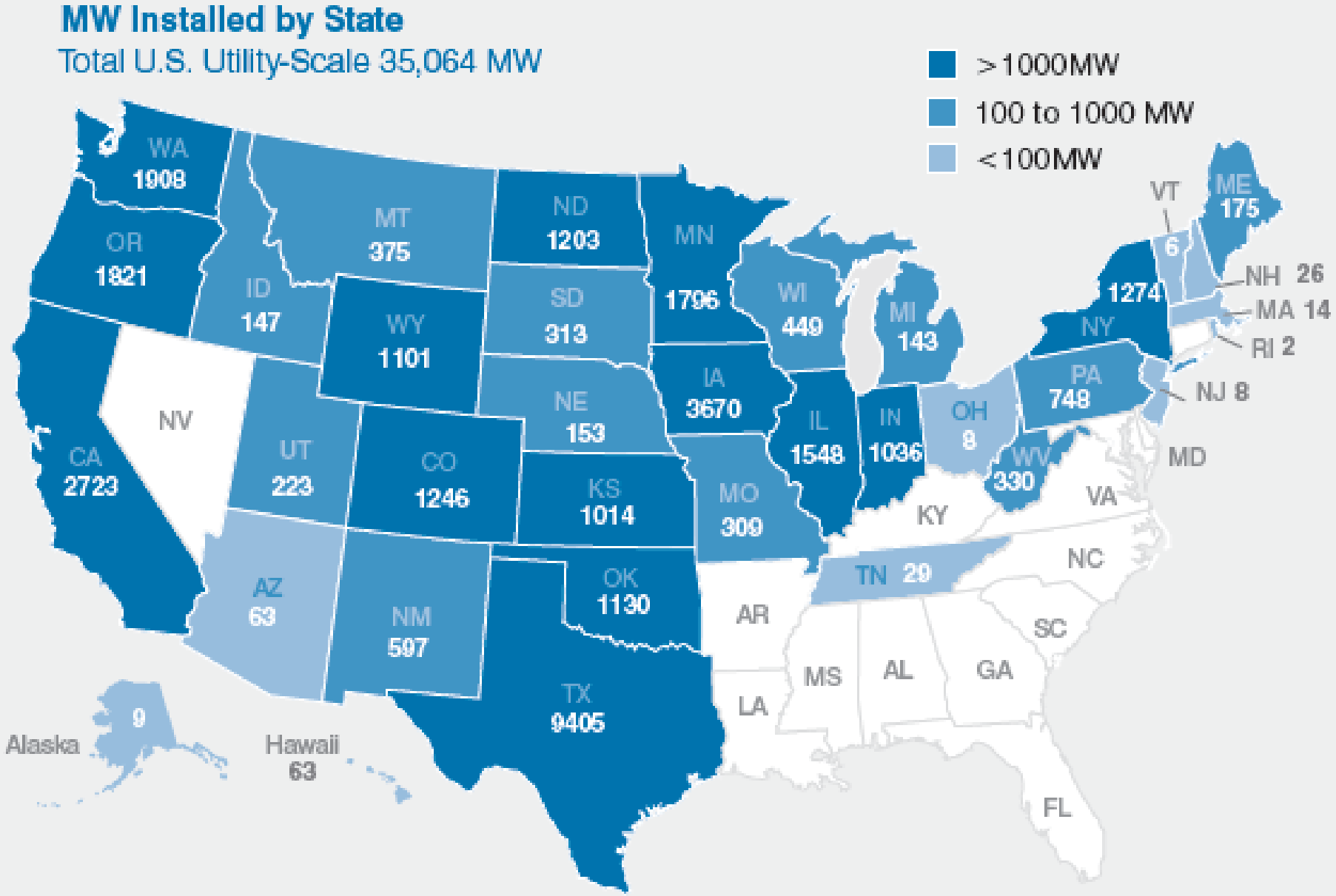
PERCENTAGE OF NEW CAPACITY ADDITIONS

For the past five years, wind power has been one of the largest new sources for electricity generating capacity.

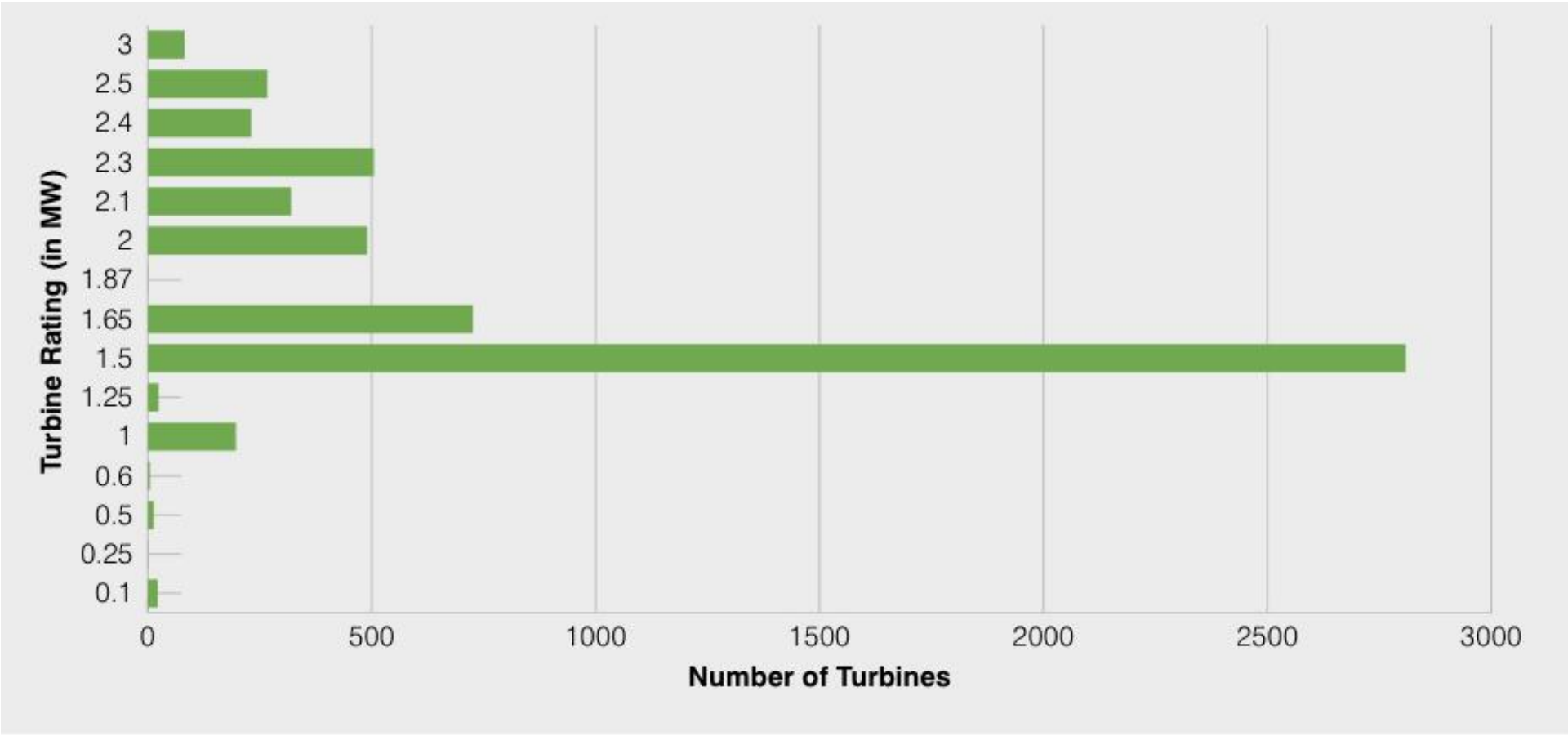


Source: American Wind Energy Association

WIND POWER CAPACITY INSTALLED BY STATE



DISTRIBUTION OF TURBINES INSTALLED IN 2009 BY CAPACITY



Source: American Wind Energy Association U.S. Wind Industry Annual Market Report – Year Ending 2009

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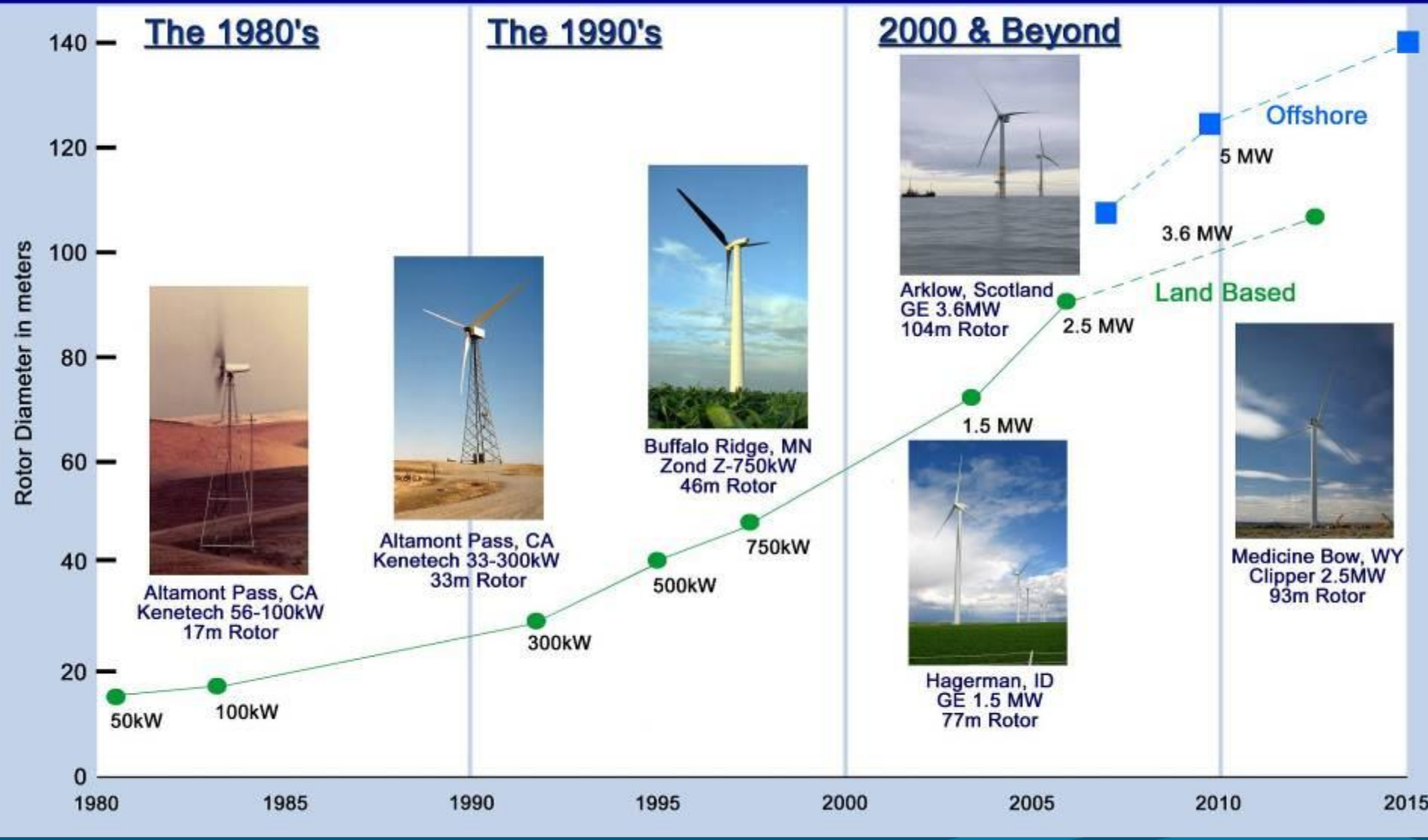
Wind Turbine Supply Chain – Overview

Evolution of U.S. Commercial Wind Technology



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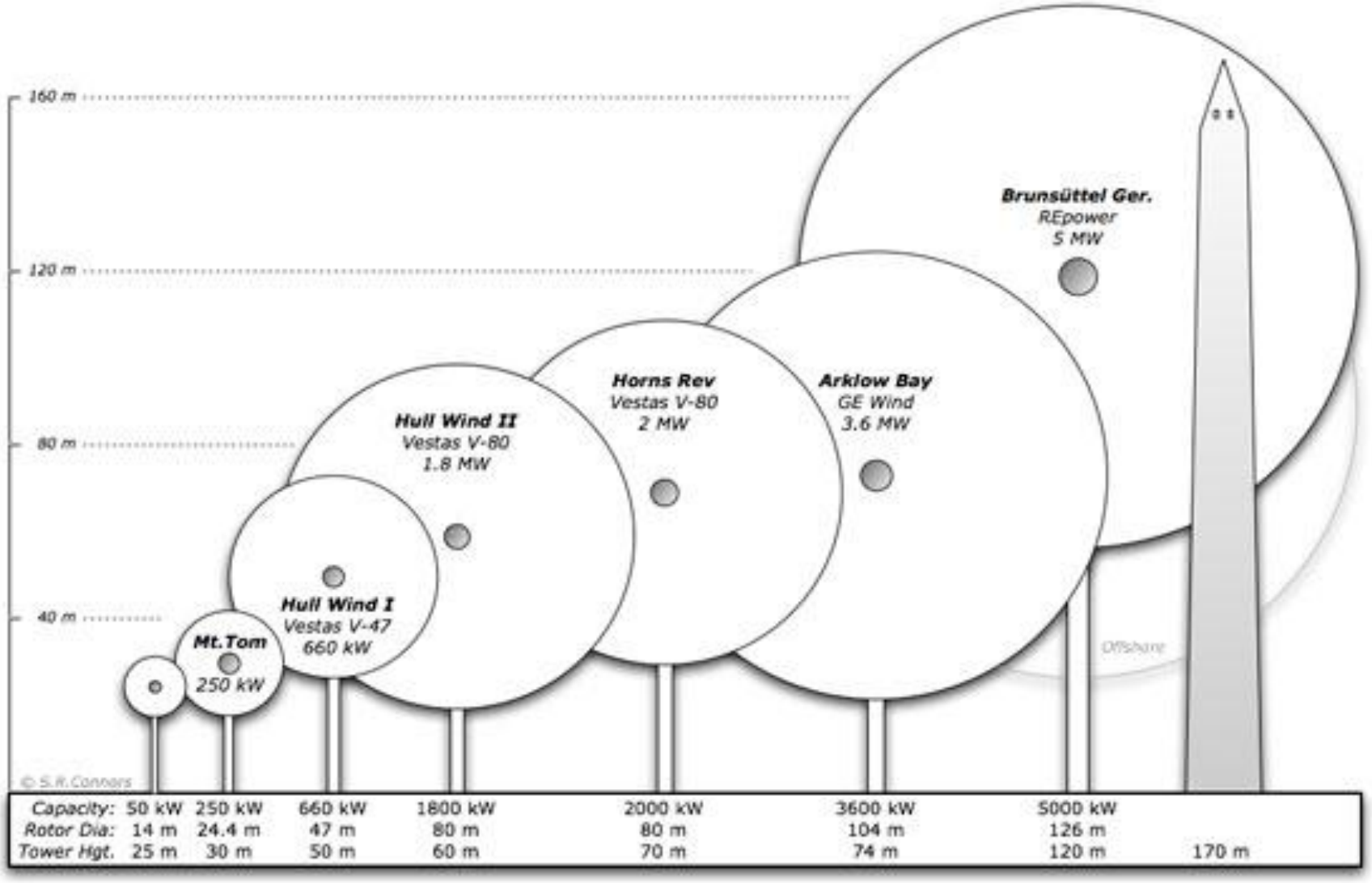
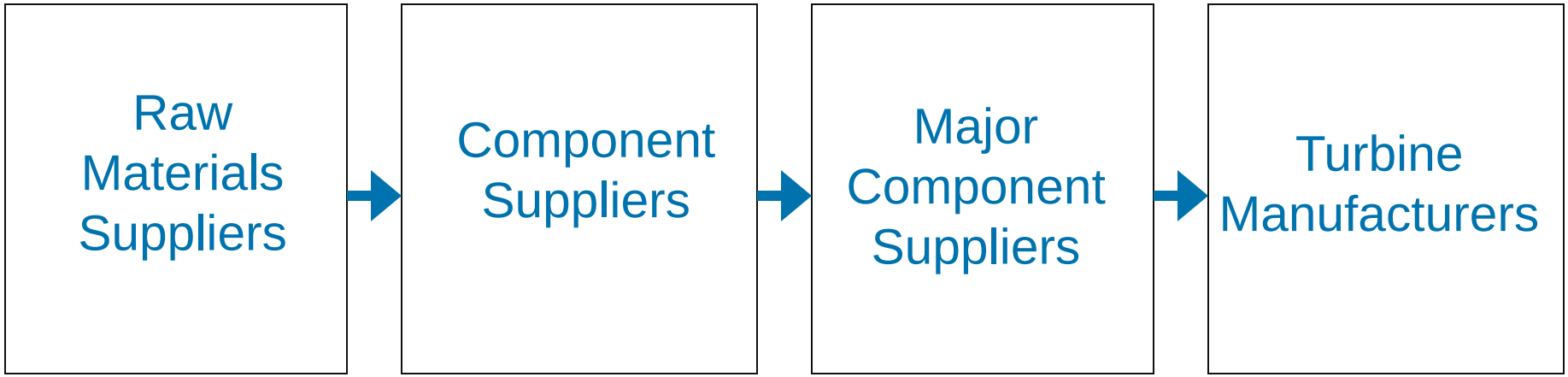
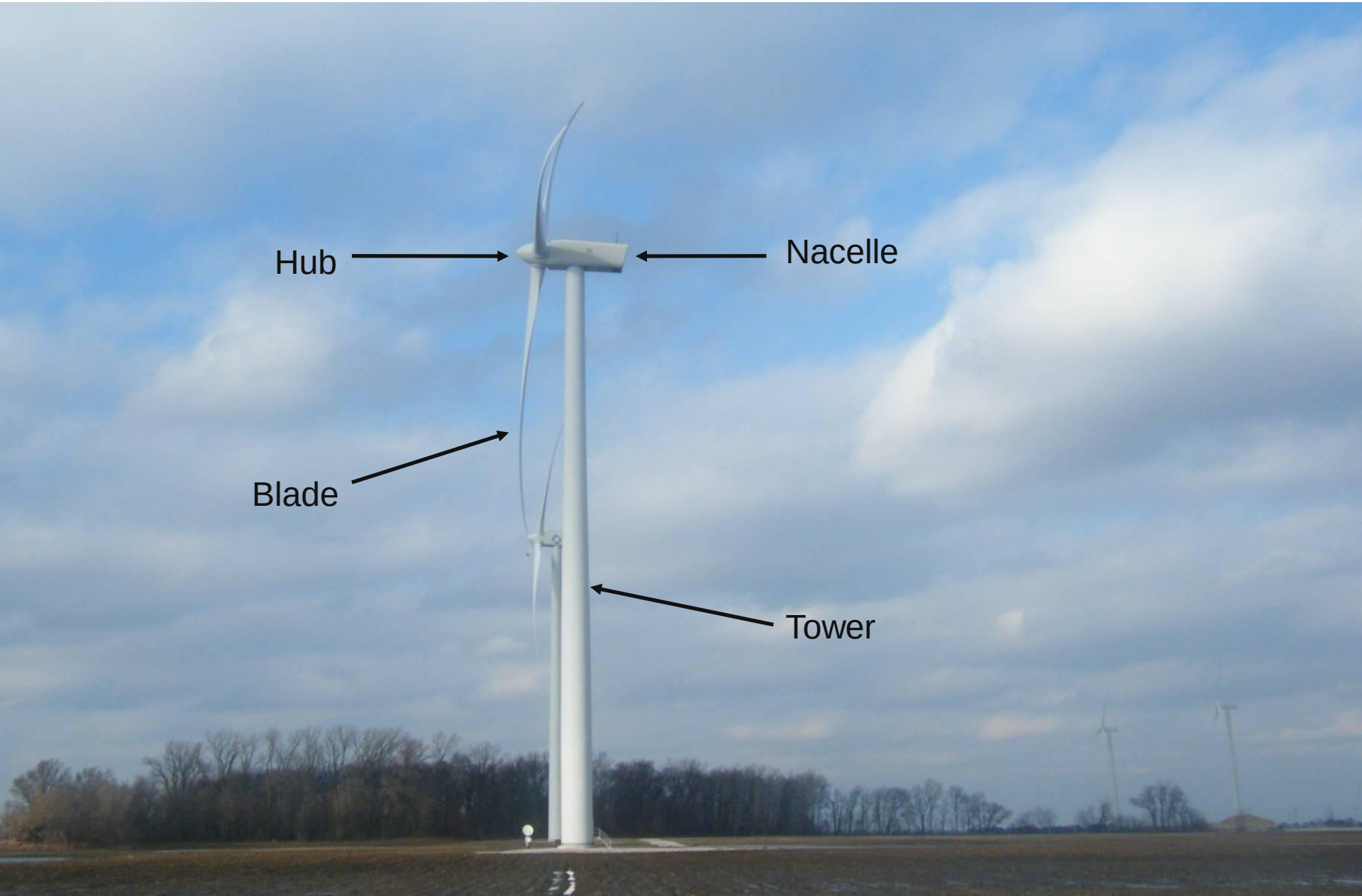
Wind Turbine Size



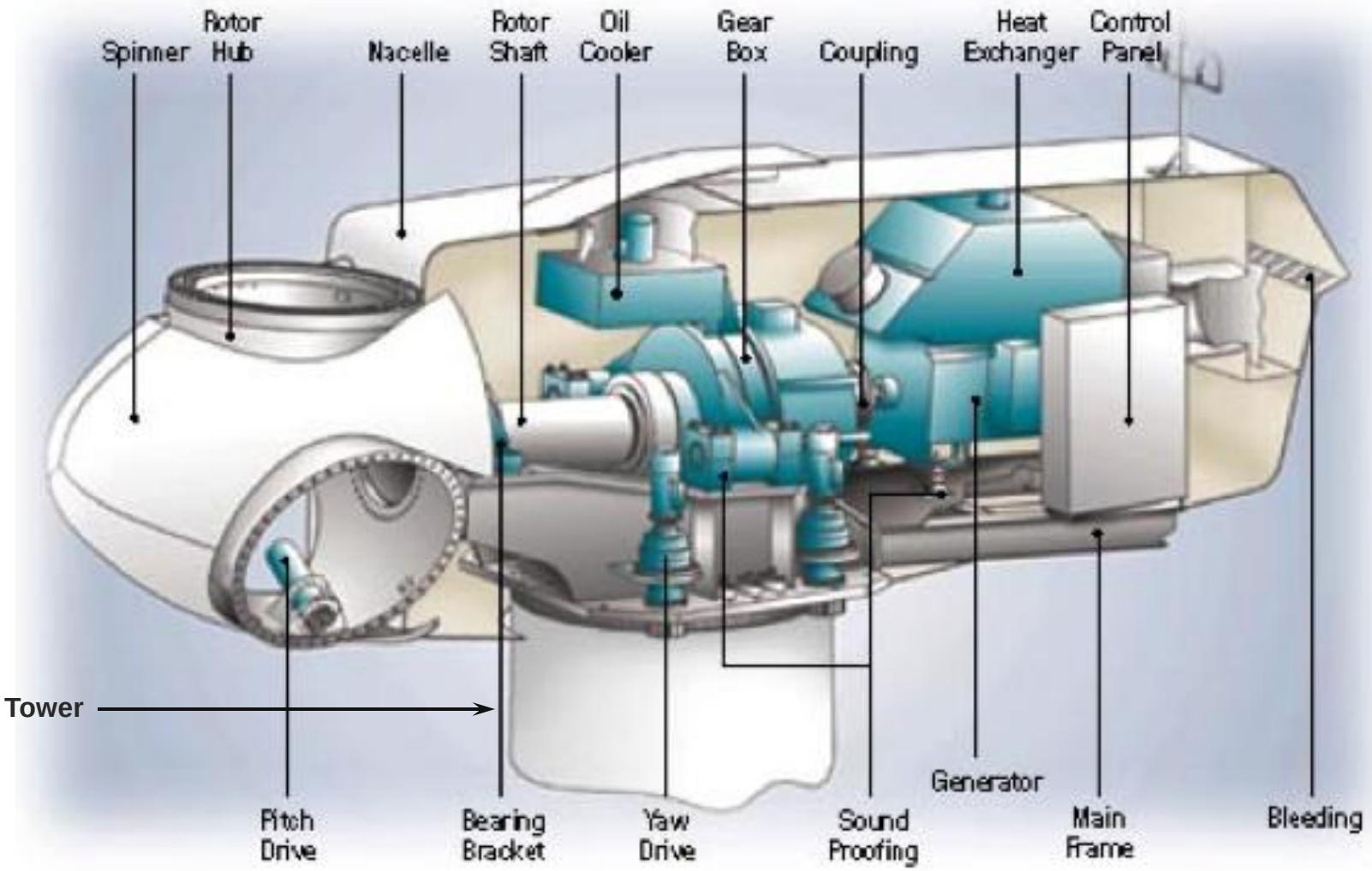
Basic Supply Chain



Wind Turbine Major Components



Inside a Wind Turbine Nacelle



Turbine Components

There are over 8000 components in a turbine, including:

Towers:

- Towers
- Ladders
- Lifts

Rotor:

- Hub
- Nose Cone
- Blades
- - Composites
- - Blade Core
- Pitch Mechanisms
- Drives
- Brakes
- Rotary Union

Nacelle:

- Nacelle Cover
- Nacelle Base
- Heat exchanger
- Controllers
- Generator
- Power Electronics
- Lubricants
- Filtration
- Insulation
- Gearbox
- Pump
- Drivetrain
- Ceramics
- Shaft

Foundation:

- Rebar
- Concrete
- Casings

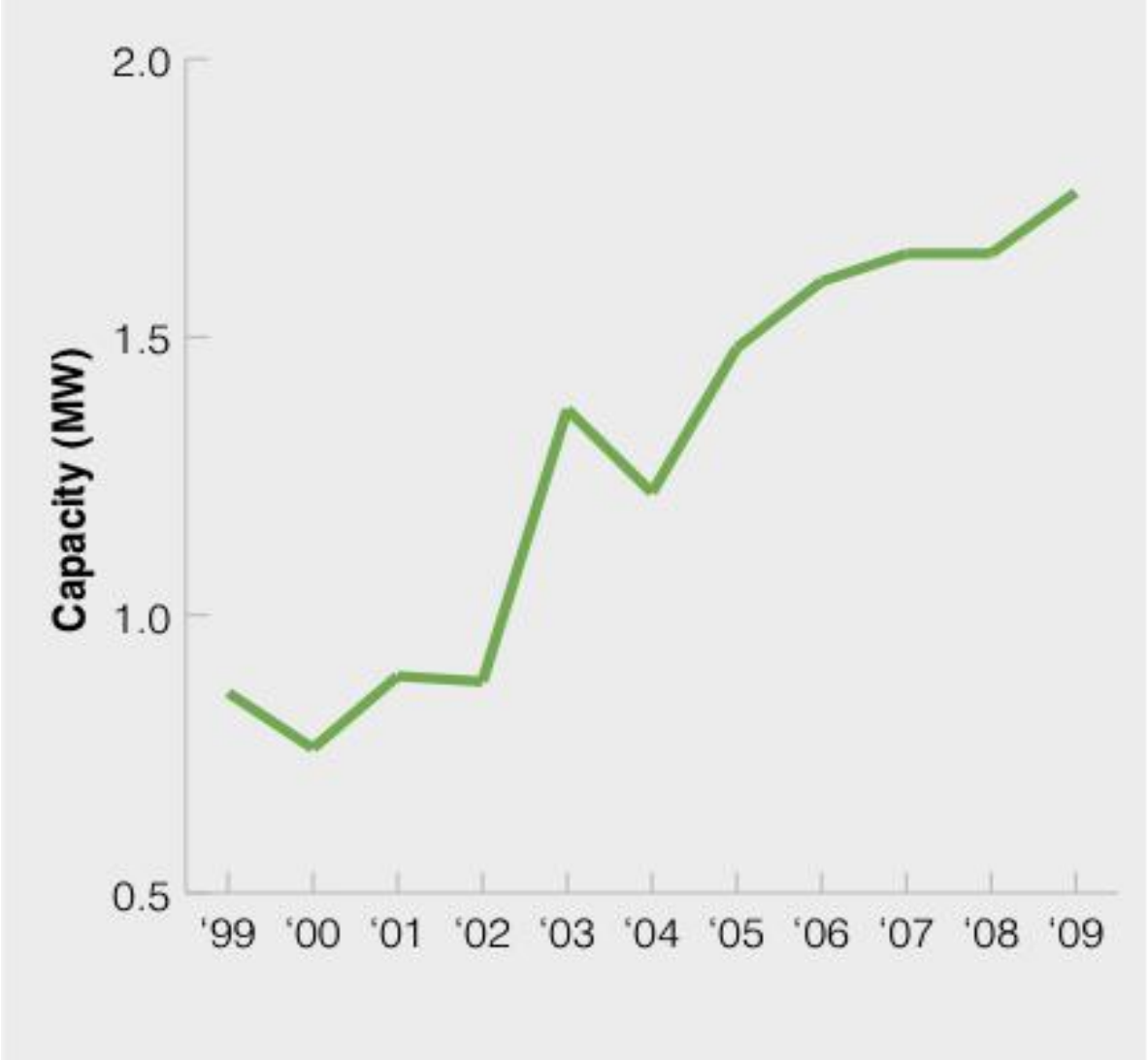
Other:

- Transformers
- Bolts/Fasteners
- Wire
- Paints and Coatings
- Lighting
- Lightning Protection
- Steel Working/Machining
- Communication Devices
- Control & Condition Monitoring Equipment
- Electrical Interface & Electrical Connection
- Batteries
- Bearings
- Brakes

AVERAGE WIND TURBINE CAPACITY

Over 5,600 turbines were installed in 2009, bringing the total to over 33,000 turbines.

The average capacity for new turbines added in 2009 was 1.75 MW, up from 1.67 MW in 2008.



Source: American Wind Energy Association U.S. Wind Industry Annual Market Report – Year Ending 2009

SIZES AND MATERIAL USE FOR UTILITY-SCALE TURBINES INSTALLED IN 2009

Capacity range:	1-3 MW
Tower height range:	45-105 meters
Rotor diameter range:	57-101 meters
Blade length range:	26.8-49 meters

Component	% Weight	% Steel
Rotor		
Hub	6.0%	100%
Blades	7.2%	2%
Nacelle		
Gearbox	10.1%	96%
Generator	3.4%	65%
Frame	6.6%	85%
Tower	66.7%	98%

Source: DOE 20% Wind Energy by 2030

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Wind Turbine Supply Chain – Major Components

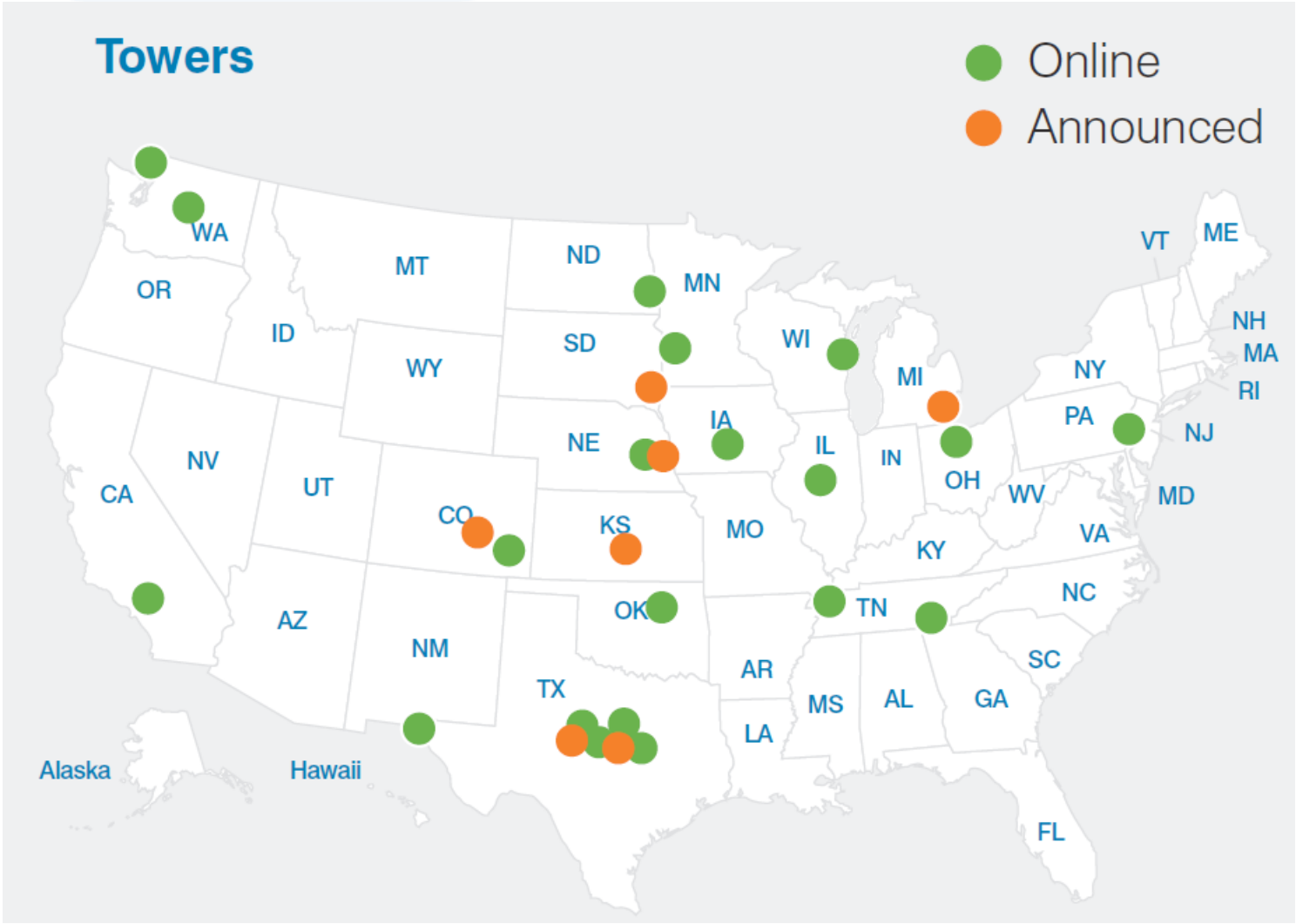
TOWERS

Credit : Carell Corp.

TOWERS – Market Overview

- The tower sector was the first to develop a strong domestic supply base due to logistical issues of transporting towers. Most towers installed in the US are domestically manufactured.
- Towers are typically 2/3 of the weight of 200 to 400 ton utility-scale turbines, and are almost entirely steel
- Number of facilities in 2004: 6
- Number of facilities in 2009: 20
- Additional announced facilities: 8

TOWERS – Mfg Locations

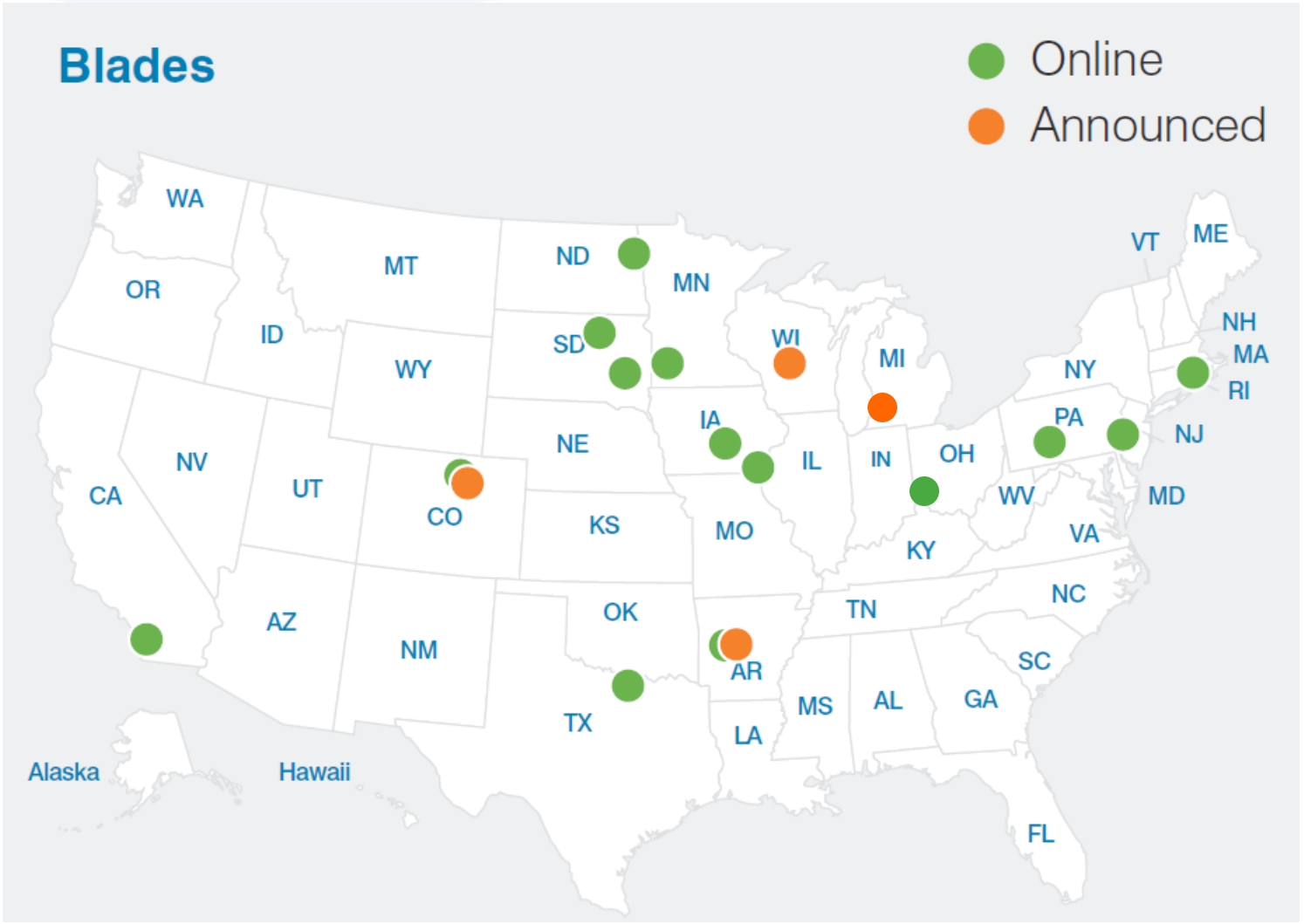


BLADES

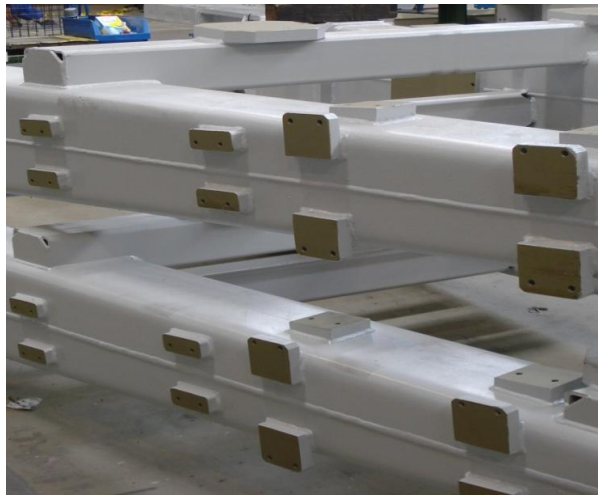
BLADES – Market Overview

- The blade sector was the second to develop a strong domestic supply base due to logistical issues of transporting blades. Most blades installed in the US are domestically manufactured.
- Number of facilities in 2004: 4
- Number of facilities in 2009: 9
- Additional announced facilities: 3

BLADES – Mfg Locations



DRIVE-TRAIN



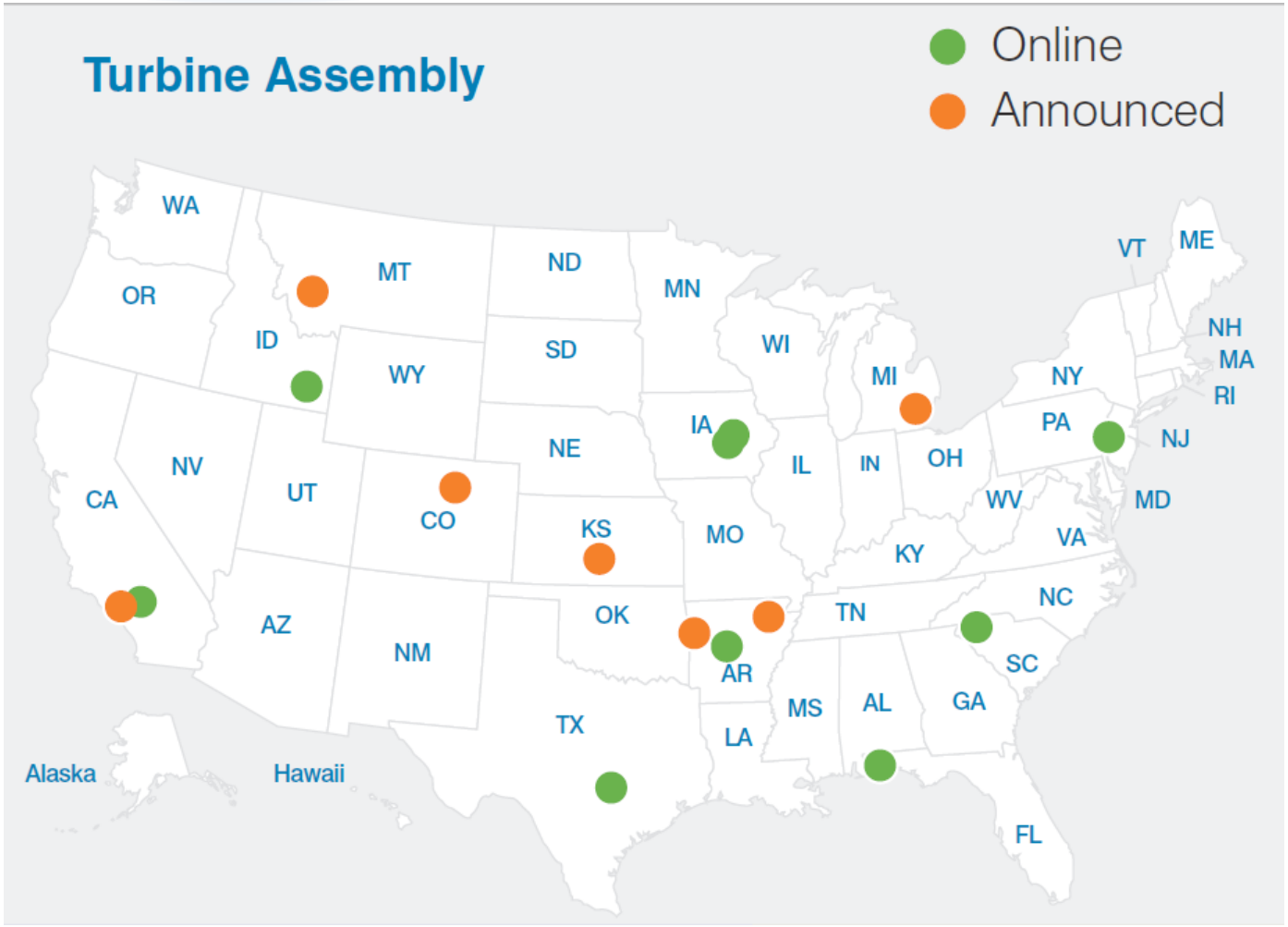
DRIVE-TRAIN – Market Overview

- The drive train contains multiple value-added areas
- The U.S. is still in the process of developing manufacturing capacity for drive train components
- Domestic drive train sourcing is driven by the presence of nacelle assembly facilities.

Nacelle assembly facilities:

- Number of facilities in 2004: 3 (all GE)
- Number of facilities in 2009: 8
- Additional announced facilities: 8

TURBINE ASSEMBLY – Locations



ELECTRICAL COMPONENTS

ELECTRICAL COMPONENTS

- Types of Electrical Components:
  - Generators
  - Slip Rings
  - Converters
  - Transformers
  - Electrical Wire & Cable
  - Fiber Optics
  - Control Systems & Condition Monitoring
  - Cable Accessories
  - SCADA Systems
  - Lightning Protection
  - Communication Devices
  - Batteries
  - Electrical Interface and Connection
  - Switchgear
  - Grid Connection Equipment
  - Motors

ELECTRICAL – Market Overview

- For many electrical commodities – U.S. in nascent stage of developing manufacturing capacity
- High OEM Visibility and Focus
  - High impact on reliability / total cost of ownership
  - Highly specified - heavily influenced by European standards.
  - May be proprietary technology
  - Safety implications
- Driving sourcing from current overseas suppliers
- Migration is in progress

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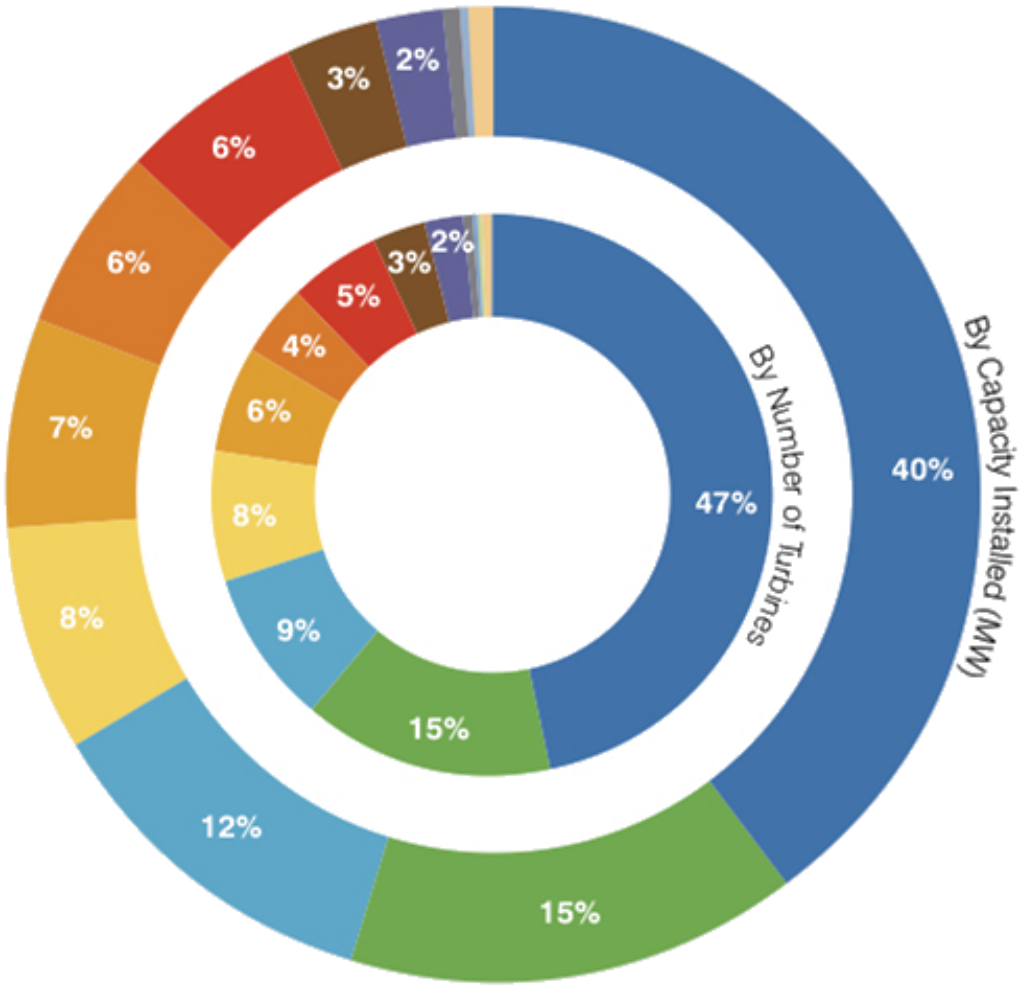
Manufacturing Facilities and Jobs

GROWTH OF OEMS IN U.S. MARKET

2005	2006	2007	2008	2009
GE Energy	GE Energy	GE Energy	GE Energy	GE Energy
Vestas	Siemens	Vestas	Vestas	Vestas
Mitsubishi	Vestas	Siemens	Siemens	Siemens
Gamesa	MItsubishi	Gamesa	Suzlon*	Mitsubishi
Suzlon	Suzlon	Mitsubishi	Gamesa	Suzlon*
	Gamesa	Suzlon	Mitsubishi	Clipper
		Clipper	Clipper	Gamesa
		Nordex	Acciona Windpower	REpower
			REpower	Acciona Windpower
			Fuhrlander	Nordex
			DeWind	AAER
			EWT	DeWind
			Northern Power Systems	Goldwind
				Northern Power Systems
				Fuhrlander

Source: American Wind Energy Association U.S. Wind Industry Annual Market Report – Year Ending 2009

MANUFACTURERS' SHARE OF 2009 INSTALLATIONS IN U.S.

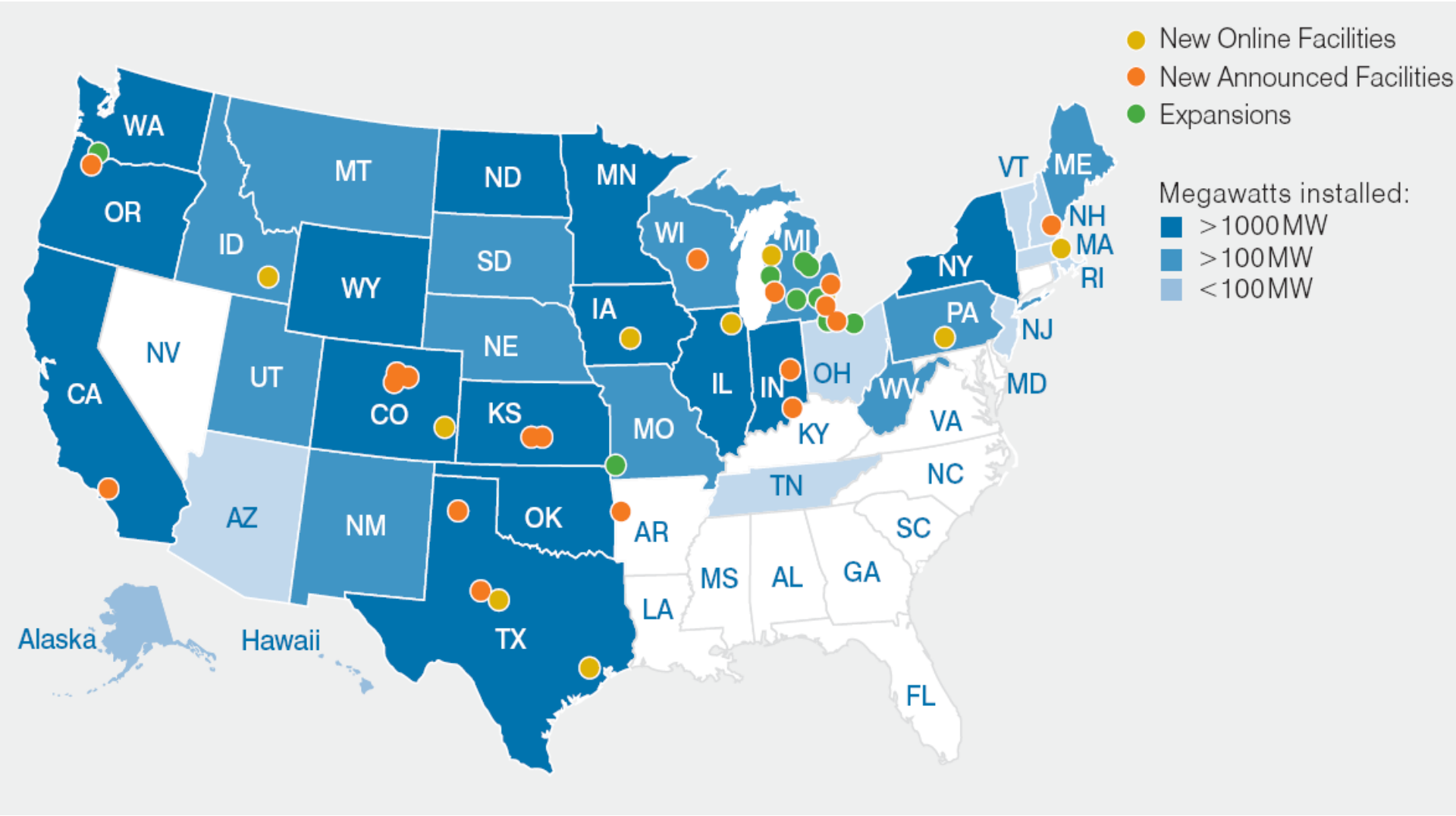


Company	# of Turbines	MW Capacity
GE Energy	2663	3995
Vestas	830	1488
Siemens	505	1162
Mitsubishi	428	751
Suzlon*	344	702
Clipper	242	605
Gamesa	300	600
REpower*	165	330
Acciona Windpower	136	204
Nordex	25	63
AAER	4	6
DeWind	3	6
Goldwind	3	5
Northern Power Systems	32	3
Fuhrlander	2	3
unknown	20	74
Total (Utility-Scale)	5702	9996

**Suzlon owns 91% of REpower*
Includes Turbines 100 kW and larger
Turbine installation data is reported by the project owner.

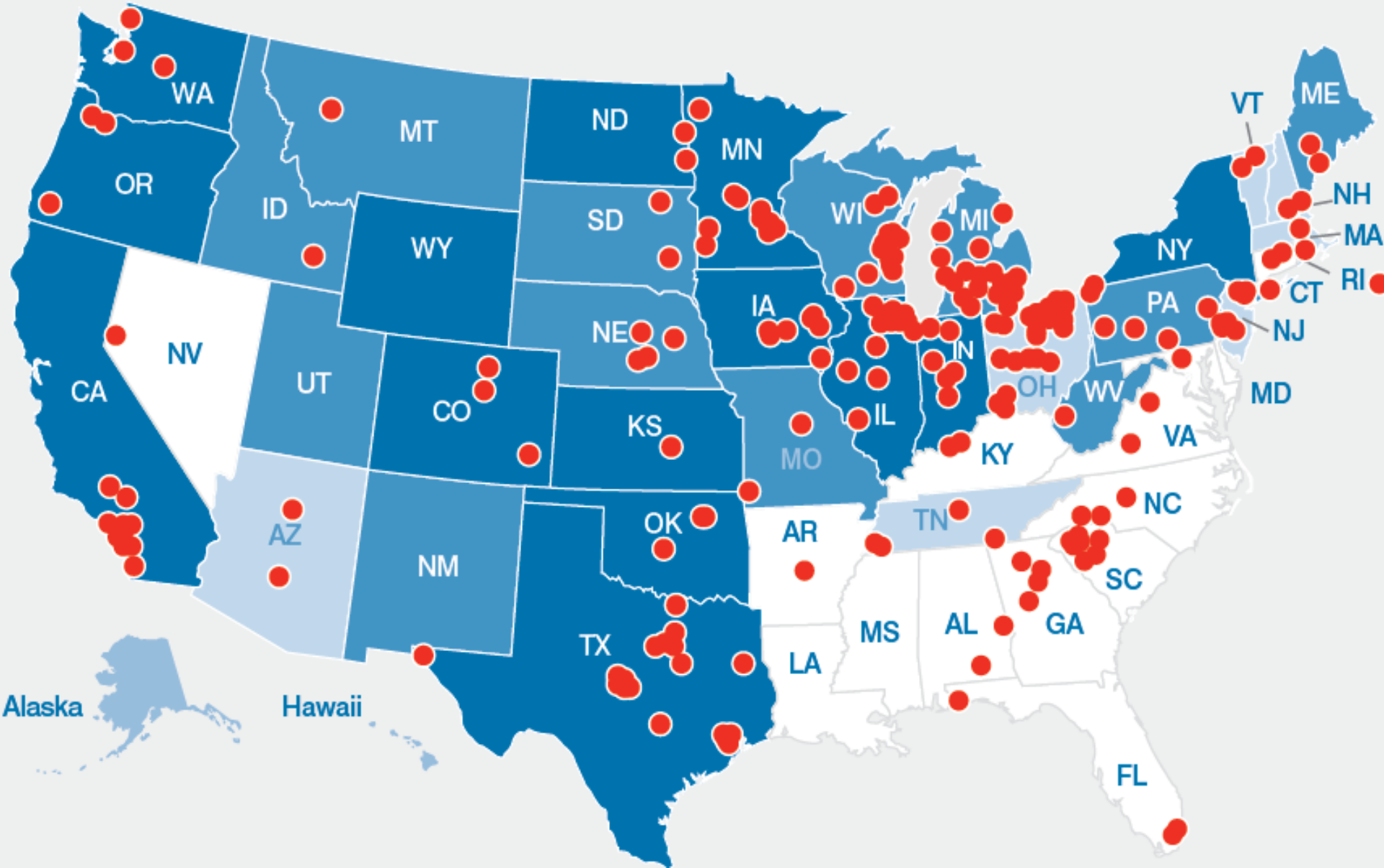
Source: American Wind Energy Association U.S. Wind Industry Annual Market Report – Year Ending 2009

NEW WIND MANUFACTURING FACILITIES IN 2009



Source: American Wind Energy Association U.S. Wind Industry Annual Market Report – Year Ending 2009

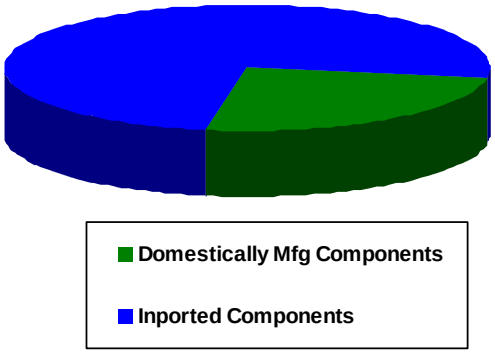
ALL ONLINE WIND MANUFACTURING FACILITIES



GROWTH OF DOMESTIC CONTENT

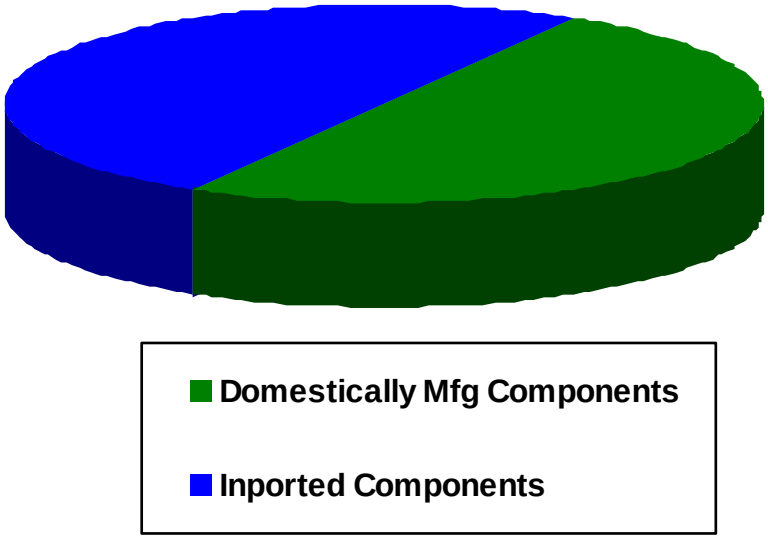
There has been a dramatic shift towards domestic manufacturing for wind turbine components

2005



~25% domestic components
~2,500 MW installed
~1,500 turbines installed

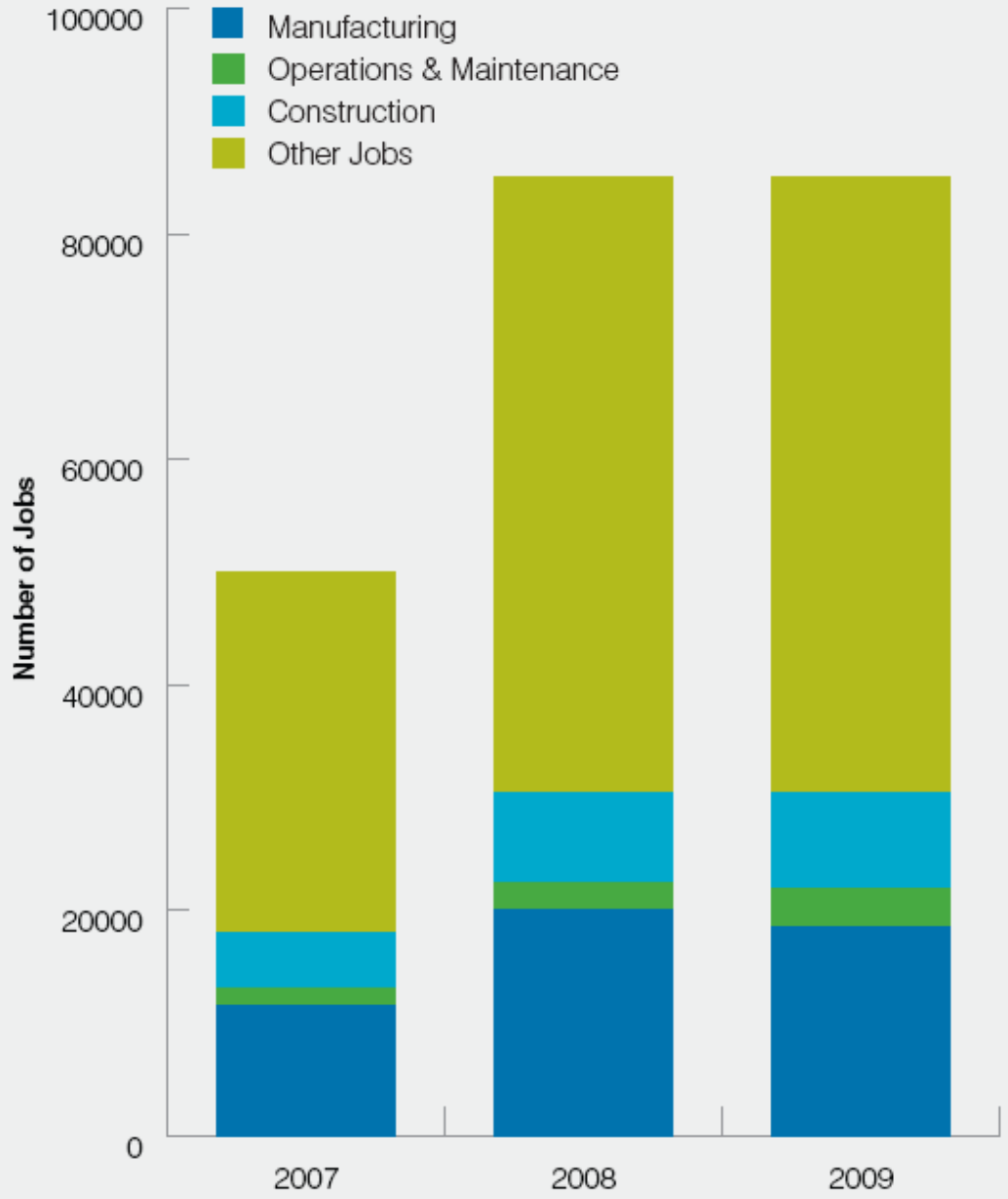
2009



~50% domestic components
~10,000 MW installed
~5,600 turbines installed

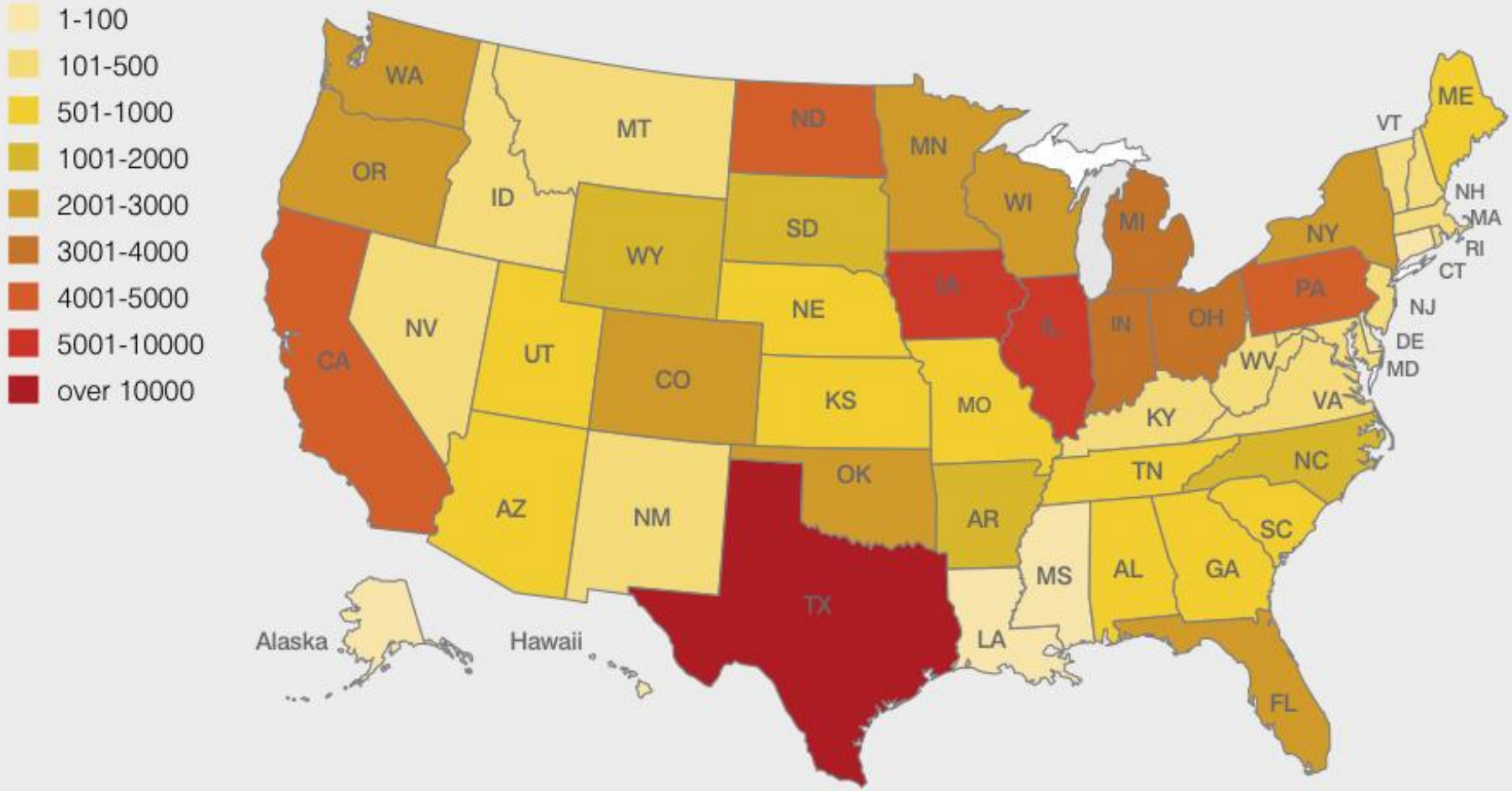
Source: American Wind Energy Association U.S. Wind Industry Annual Market Report – Year Ending 2009

TOTAL U.S. WIND INDUSTRY EMPLOYMENT



Other jobs include: some manufacturing, parts related services (repair shops, equipment manufacturers and suppliers) financial and consultant services (financiers, accountants, consultants), developers and development services (developers, land acquirement, permitting, wind resource assessors), contracting and engineering services (contractors, electrical engineers, mechanical engineers, civil engineers), transportation and logistics

WIND INDUSTRY JOBS BY STATE



Source: American Wind Energy Association U.S. Wind Industry Annual Market Report – Year Ending 2009

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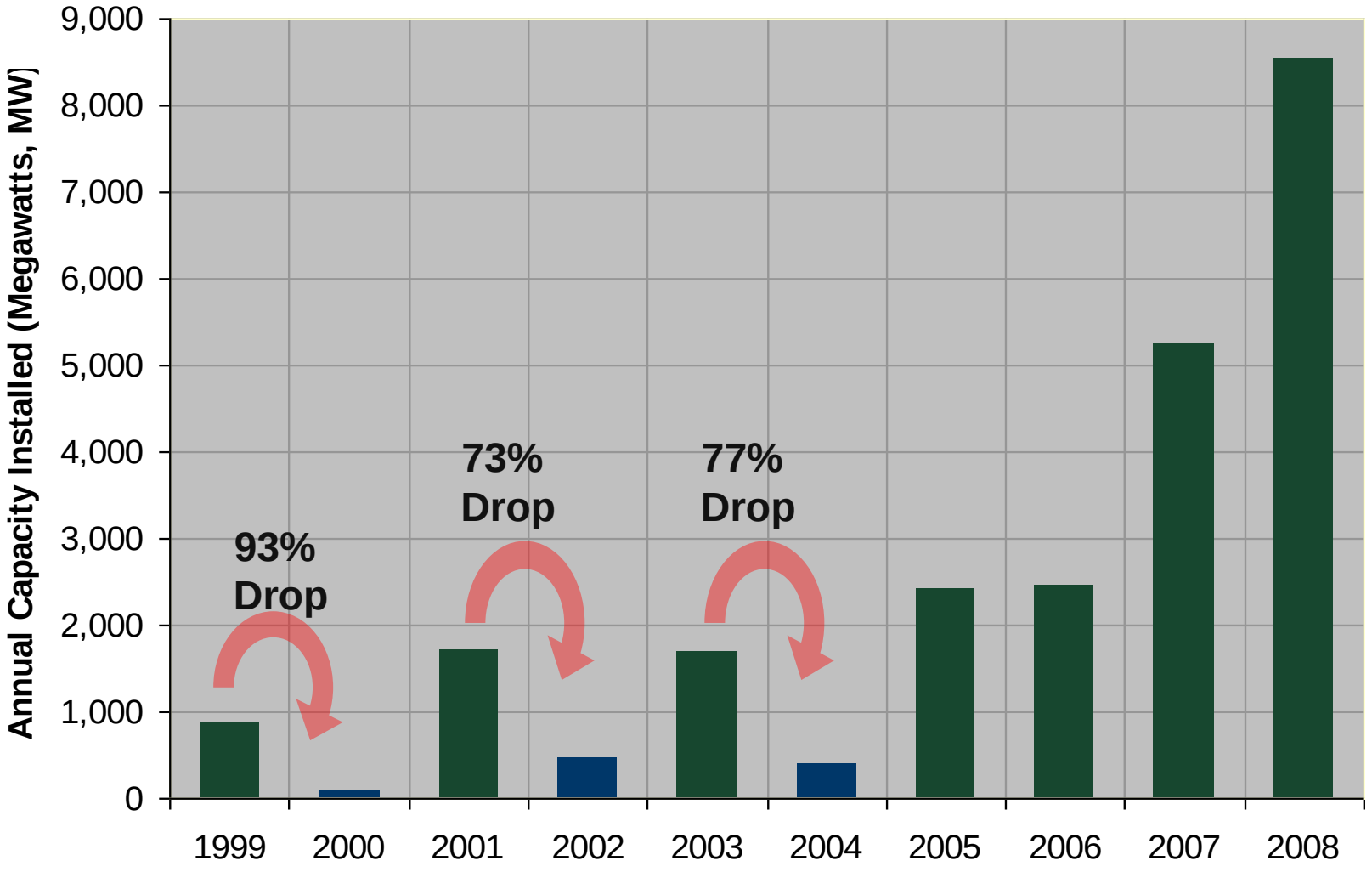
Policies to Support Wind Power Growth, Manufacturing, Jobs

Federal PTC & Wind Installations



Legislative Priorities

☑ **In Place – Recovery Act/Stimulus Bill**

- **Production Tax Credit (PTC) through 2012 for wind projects**
- **Option to choose Investment Tax Credit (ITC) instead of Production Tax Credit and to convert ITC to grant**

☐ **Near-term Action - Comprehensive policy**

- **National Renewable Electricity Standard**
- **National Transmission Legislation**
- **Jobs Bill Provisions**

New Policies Needed

- 2008 Credit Crisis slashed wind project investment
  - Immediate “fix”
- Long-term, stable federal policy to continue wind power growth and enhance domestic wind component manufacturing

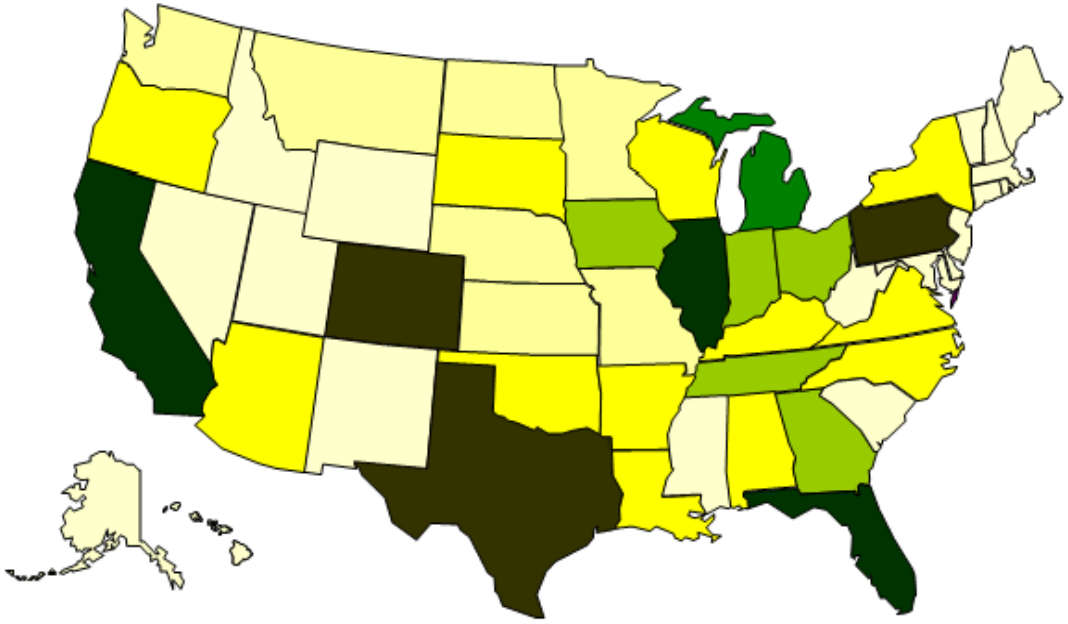
National RES

- RES = Renewable Electricity Standard
- 25% of the nation's electricity to come from renewables by 2025
  - Set an aggressive near-term target for 2012
- Will send strong signal to businesses that we are committed to the US manufacturing base

Why a National RES ?

…. But with a 25% RES by 2025, every state will see renewable electricity supported job growth.

Change in Renewable Electricity Supported Jobs in 2025 With a 25% RES by 2025[1,2,3]



Range			Unit	Color
Greater than		20,000	Jobs	
17,500	to	20,000	Jobs	
15,000	to	17,500	Jobs	
12,500	to	15,000	Jobs	
10,000	to	12,500	Jobs	
7,500	to	10,000	Jobs	
5,000	to	7,500	Jobs	
2,500	to	5,000	Jobs	
-	to	2,500	Jobs	
	No Gain		Jobs	

Source: Navigant Consulting, Inc.

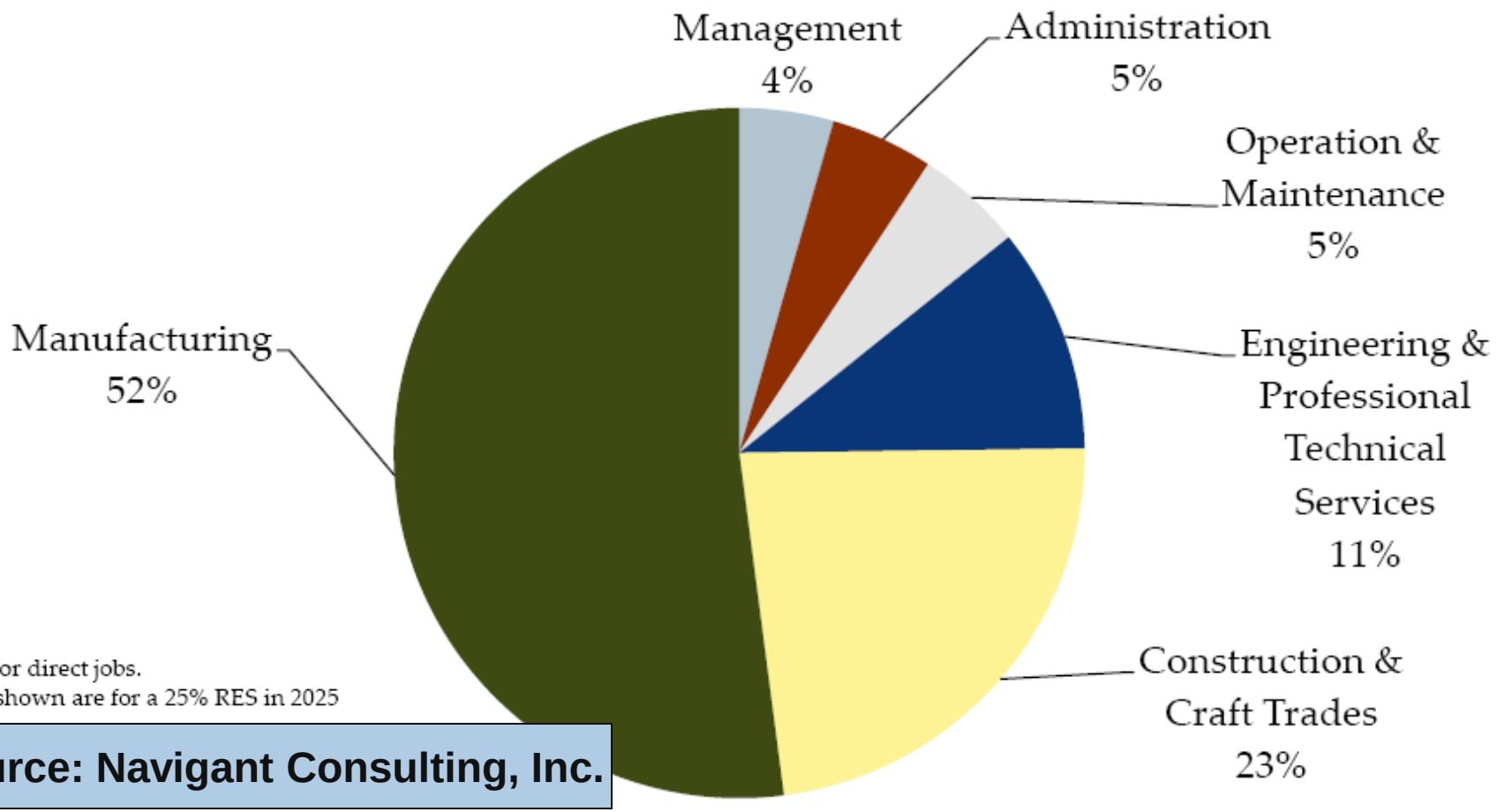
Source: NCI December, 2009

1. Data included direct, indirect, and induced labor
2. Results are for employment supported by the biomass power, qualified hydropower, waste-to-energy power, solar power and wind power industries.
3. Plot shows the incremental cumulative increase in employment comparing a 25% RES by 2025 to no National RES in 2025.

Why a National RES ?

Direct jobs in the renewable electricity industry are focused in construction and manufacturing, but span many sectors.

Distribution of Direct Jobs in the Renewable Electricity Industry: 2009 – 2025[1,2]



1. Data is for direct jobs.
2. Results shown are for a 25% RES in 2025

Source: Navigant Consulting, Inc.

Manufacturing Policy – 48C

- The Recovery Act included a 30% investment tax credit for new investments in clean energy manufacturing.
- In early 2010, the Treasury announced recipients of the $2.3 billion manufacturing tax credit program.

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Manufacturing Opportunities – Resources and Services

AWEA – BGA - USW Report

- **"Winds of Change: A Manufacturing Blueprint for the Wind Industry"**
- **Covers the status of the American wind energy manufacturing sector and the policies needed to put more Americans to work manufacturing for the wind industry.**
- **Obtain a copy by e-mailing:** manufacturing@awea.org

Report Recommendations

Report contains nine recommendations:

- **1) National Renewable Electricity Standard (RES)**
- **2) Long-Term Price Signal on Carbon**
- **3) Recovery Act's Convertible Tax Credit - ARRA 1603 Program**
- **4) Advanced Energy Manufacturing Tax Credit (MTC) - ARRA 48C Program**

Report Recommendations

- 5) Loan Guarantees for Commercial Manufacturing of Clean Energy
- 6) Investments of Manufacturing Progress and Clean Technology (IMPACT) Act
- 7) Renewable Energy Market Access Program (REMAP)
- 8) The Green Jobs Act
- 9) The Transmission Grid Infrastructure

Manufacturing Working Group

- AWEA "Manufacturing Working Group" open to any AWEA business member in good standing who has US-based manufacturing and is a current supplier for the industry.
- Will soon be forming specific "sub-teams" to address items in AWEA-BGA-USW Report.
- AWEA Members engaged in manufacturing encouraged to join these "sub-teams" asap.
- Contact AWEA for more information at: manufacturing@awea.org

Transportation & Logistics WG

- This working group is open to any AWEA business member in good standing who is involved in the transport and logistics associated with moving, storing and delivering wind turbines and turbine components.
- Conference call in early August to establish co-chairs, steering committee and series of webinars and “sub-teams”
- Contact: Tom Maves, tmaves@awea.org

GLWN: Global Wind Network

- **Leading Supply Chain Advisory Group**
- **1500 Manufacturers and Suppliers across North America**
  - ***Component Head-hunters for OEMs***
  - ***Connection to Developers, Project Mgrs***
  - ***Resource to Manufacturers, Service Suppliers***
- **Mission: Increase the Domestic Content of our Wind Turbines**
- **Get Connected: GIS Supply Chain Map**

www.glwn.org

A WIRE-Net Initiative

Report Follow-On Effort

- Wind Energy "Supplier Handbook"
  - How the Wind Energy Industry supply chain works
  - Who buys what from whom
  - How to get involved / how to get qualified
- Report to be issued in October 2010
- Pre-order a copy: manufacturing @awea.org

Next AWEA Supply Chain Event

- October 5-7, 2010: AWEA + CanWEA "North American Offshore Wind Conference & Exhibition" – Atlantic City, NJ
- Supply Chain Track – six sessions focused on supply chain opportunities in offshore wind
- For more info: www.offshorewindexpo.org

Questions ?

Jeff Anthony – Director of Business Development

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WINDPOWER 2011 – Anaheim, CA – May 2011

www.windpowerexpo.org